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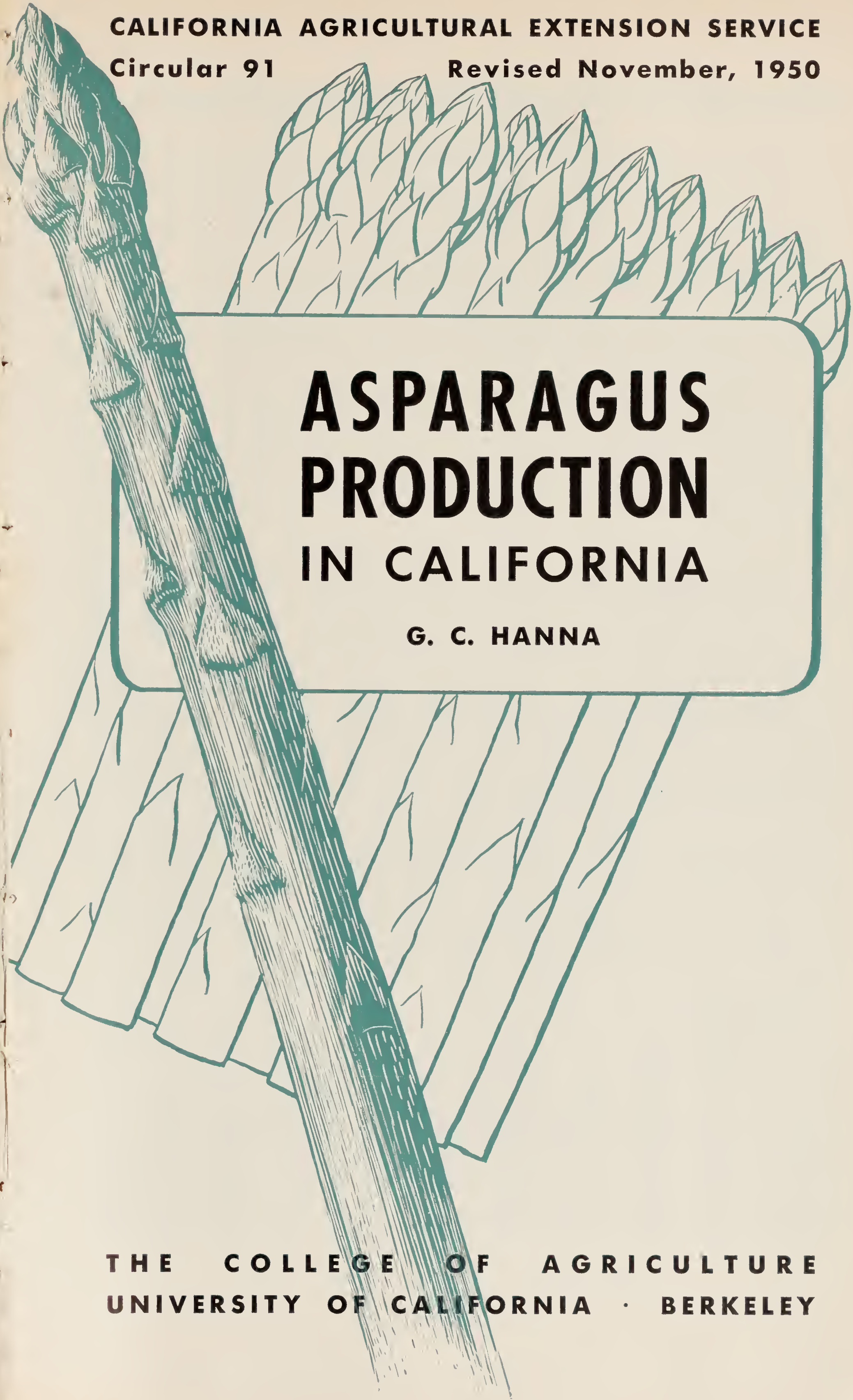

# ASPARAGUS PRODUCTION IN CALIFORNIA

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***Asparagus is considered one of the important*** field crops in California, despite the fact that its requirements as to soil, irrigation, and climate limit commercial growing principally to three areas. These are the Sacramento-San Joaquin, San Fernando, and Imperial valleys.

To produce paying crops of asparagus considerable labor and expense are needed. Yet compared with most cultivated crops in this state, the fields when once established do not require highly specialized upkeep; and asparagus is comparatively free from insect pests or diseases.

This circular was compiled to give both the established grower and the beginner in the industry the latest available data on asparagus growing. It includes tested methods of maintaining the asparagus bed at a productive level during its profitable life—which averages 11 years—as well as information on establishing the new plantation.

Included for quick reference are grades and requirements as to packing and branding the fresh product for market, according to the California Agricultural Code.

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# ASPARAGUS PRODUCTION IN CALIFORNIA

### G. C. HANNA[1]

ASPARAGUS is grown in nearly all sections of the United States, but large industrial production is limited to a few localities.

In 1945, in the nation, 126,258 acres were used for commercial growing of asparagus. About half of this acreage was located in California, according to data from the United States Department of Agriculture. In this state the principal areas of asparagus production are the Sacramento-San Joaquin, San Fernando, and Imperial valleys.

Before 1934, California canneries packed over 90 per cent of the canned asparagus. Since then, the canning industry has increased in other states and the total pack in California has remained about the same. In 1945, California canned only 63 per cent of the nation's asparagus.

Practically all the asparagus which is canned white is grown in the Sacramento-San Joaquin Delta. Since 1932 canned green asparagus has grown in popularity. Figure 1 shows the trend of the green canned product.

The average yield per acre in California is about 2,300 pounds, with some fields producing 5,000 pounds or more.

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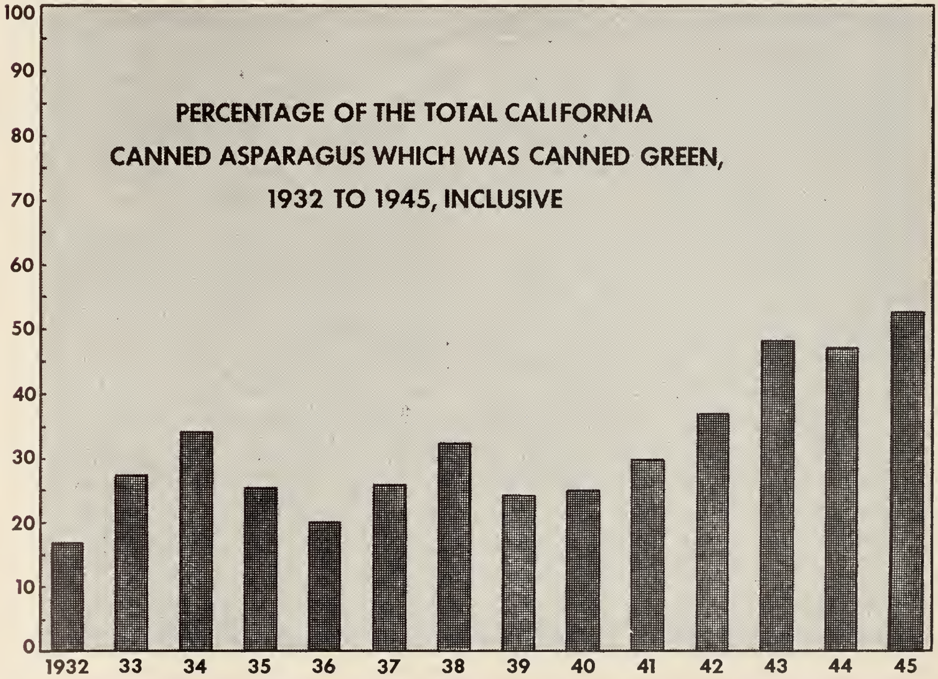

Fig. 1.—Trend of canned green asparagus, 1932–1945.

## Climate and Soil Requirements

For heaviest yields of asparagus, a rich soil 8 to 10 feet deep is needed—one which will hold water, yet be porous enough to give good drainage. Early production depends on soil that warms readily.

Most of the better-producing fields in the Delta region are found on a peat-sediment mixture, and this soil type is especially desirable in the production of white canning asparagus. It warms rapidly in the spring and because it is loose and friable, allows the spears to grow straight upward. It is less apt to be worn down by wind action than are the lighter peat and sandy soils. Clay soils warm too slowly, are difficult to manage, do not drain readily, and produce a higher percentage of crooked spears.

## Varieties and Seed Selection

**Varieties.** The principal variety grown in California is the Mary Washington. Palmetto is grown to a limited extent. There are numerous strains of Mary Washington, some much better than others. The Martha Washington, grown elsewhere in the United States, is not planted to any extent in California. Care should be taken to secure seed from high-producing beds of suitable quality, or plants grown from such seed.

**Two new strains** of Mary Washington asparagus—numbers 499 and 500—have been developed by the Division of Truck Crops and released to growers for trial.

Spear size averages medium to large in comparison with other strains, with No. 500 averaging slightly larger than No. 499. Strain 500 also has been consistently earlier than 499.

The new strains are similar in appearance except that No. 499 has a slightly darker green color. Both have tight heads, are practically free from the purple overcast which is typical of most Mary Washington strains, and have a uniform color to the ground line.

Under California conditions, both are relatively free from the enlarged nodes that are commonly found in many strains on colossal sizes. In general appearance the spears are more uniform, thus giving a better pack.

Although these strains are recommended now for trial only, they are being used extensively in commercial plantings. Since the oldest plantings of these strains have been harvested under commercial conditions for only five years, it is too early to predict how they will perform for the normal life of a bed. At the present time, the earlier No. 500 is preferred by most growers and shippers.

**Selection of Seed.** Improvement of a strain may be made by careful selection of seed. The seed plants should be taken from young beds before the crowns have grown together and lost their identity.

There is a close relation between the aboveground height of the first branch and the compactness of the head. The higher the branching, the tighter the heads during the cutting season. A good way to judge the yield of a plant three to five years old is by the amount of spread the crown has made, compared with surrounding plants. The natural growth of an asparagus plant is an ever-widening circle. A plant which produces numerous spears tends to spread faster than one which produces only a few.

Another indication of the number and size of spears which can be expected from a plant is the number and size of stalks. Plants that produce many small stalks will have many small spears; those that produce a few large stalks will have only a few large spears. Plants with rough or corrugated stalks should be avoided, for they will have the same type of spears. Plants that show (in the cross section of cut stalks) a high percentage of oblong- to flat-shaped stalks will produce a high

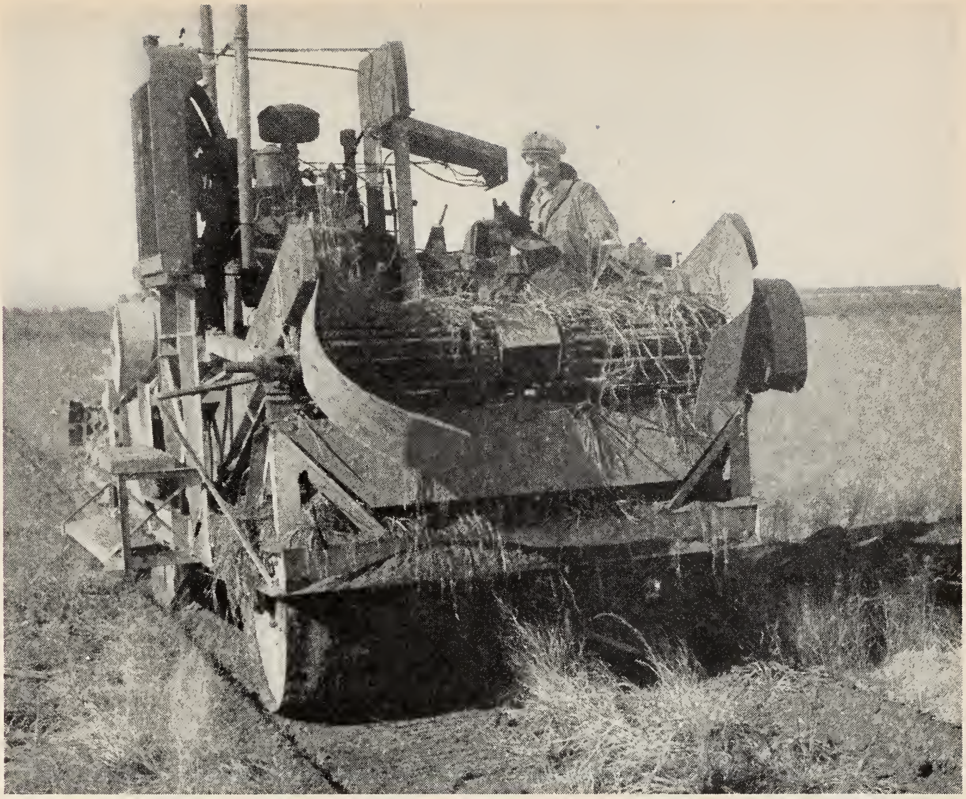

Fig. 2.—Digging crowns with a two-row potato digger.

percentage of spears of such shapes, which is objectionable.

With these facts in mind, the grower ought to select seed from plants having numerous good-sized, smooth, high-branching stalks, crowns with a wide spread, and ferns that are compact and dense, with long cladophylls (needles).

## Planting and Managing the Nursery

**Planting.** The seed should be planted as early in the spring as possible. This is particularly true in cases where the soil is known to be infested with weed seeds. Although the seeds of asparagus germinate slowly if planted in February or March, the plants will emerge before most of the summer weeds appear. A preëmergence spray, to keep down the weed growth, can be used so long as none of the asparagus seedlings has appeared aboveground. Stove oil (gravity A.P.I. not below 38°) is used at the rate of 60 to 100 gallons per acre.

Seed at the rate of 5 to 15 pounds per acre is drilled 1 or 2 inches deep in rows about 20 inches apart in the nursery. To make digging and separation easy, the final stand of plants should be about 3 inches apart. If planting is sufficiently early, the nursery should yield 80,000 to 100,000 usable crowns per acre. It has been found that early seeding, which takes advantage of natural soil moisture, requires less seed than late planting, to insure a good stand. Precision planting can be made by use of a machine with a cobbly type unit. Because it is hard to thin out the plants in the nursery, proper spacing of seed by precision planting should be depended upon to get a good stand. Equal spacing is important in the nursery. Crowns when crowded will be smaller than those growing farther apart. Some will even be useless.

**Irrigation.** Asparagus needs a good supply of moisture available at all times to insure uniform growth. It is especially necessary to keep the soil moist near the surface before the seeds sprout and when the plants are small. On sediment soils, a portable sprinkler is useful. On peat soils, subirrigation is used. In the Delta, no tiling of the land is necessary for this type of irrigation. When subirrigation is used, the grower should be careful not to raise the moisture content of the soil too high, as it tends to make weeds grow and to cause rhizoctonia rots, which kill many asparagus seedlings.

**Digging the Crowns.** At the end of one growing season, the tops are usually cut with a mower, raked, and burned. The crowns are dug in December and January. As a rule, the crowns are turned up from the soil with a moldboard plow, and pulled up with a potato hook. Lately, some growers have been using a potato digger that lifts the roots and shakes them free from most of the soil (fig. 2). This method is satisfactory provided the plowing is not too shallow. It makes the separation of the crowns easier and reduces mechanical injury that occurs when the plow and potato-hook method is used. Crown injury permits decay organisms to enter the roots and impair plant vitality.

**Selecting the Crowns.** After digging, the crowns are graded while being separated. Those that weigh less than 1/10 pound and those severely injured should be thrown away. Figure 3 shows the difference between plants that had the same chance for development in the nursery—they grew side by side, spaced 6 inches apart. The plant shown on the right has only one bud cluster; the one on the left has six. Although it is not necessary to divide the crowns, such a crown as the larger one could be separated into five or six parts, each considered a separate crown for planting. Two or three of the parts would probably be considered too small to plant and would be discarded; but really these small parts from the strong crown are far superior to those which could be taken from the plant shown at the right of the illustration (fig. 4, p. 8). Discarding the smaller portions of a large and vigorous crown cuts down the value of selection. In separating the crowns, it has been found unnecessary to break them apart to leave a single bud cluster.

## Establishing the Plantation

**Preparing the Soil.** As a rule, little income is received from an asparagus plantation during the first three years after planting. The condition of the land, therefore, should be such that cultural operations can be kept as simple and inexpensive as possible. If such weeds as morning-glory, nutgrass, nut sedge, or watergrass are growing in the soil, it will be hard to keep the field clean without costly hoeing and plowing. If possible, the land should be flooded during the previous summer and fall, then carefully disked to kill sprouting weeds. Another thorough disking just before the furrowing to plant will kill the winter weeds.

Where subirrigation is practiced, the land must be as level as possible, so that water applications will be about the same all over the field. Where the land is watered by surface irrigation, a slight fall of from 2 to 4 inches (depending on type of soil) for every 100 feet of row is needed for the best results.

**Time of Planting.** In the Sacramento-San Joaquin Delta or in the San Fernando Valley, planting is done at any time during the winter months, provided the soil is not too wet. In the Imperial Valley, fields may be planted at any time during the winter, for there is very little interference from rains.

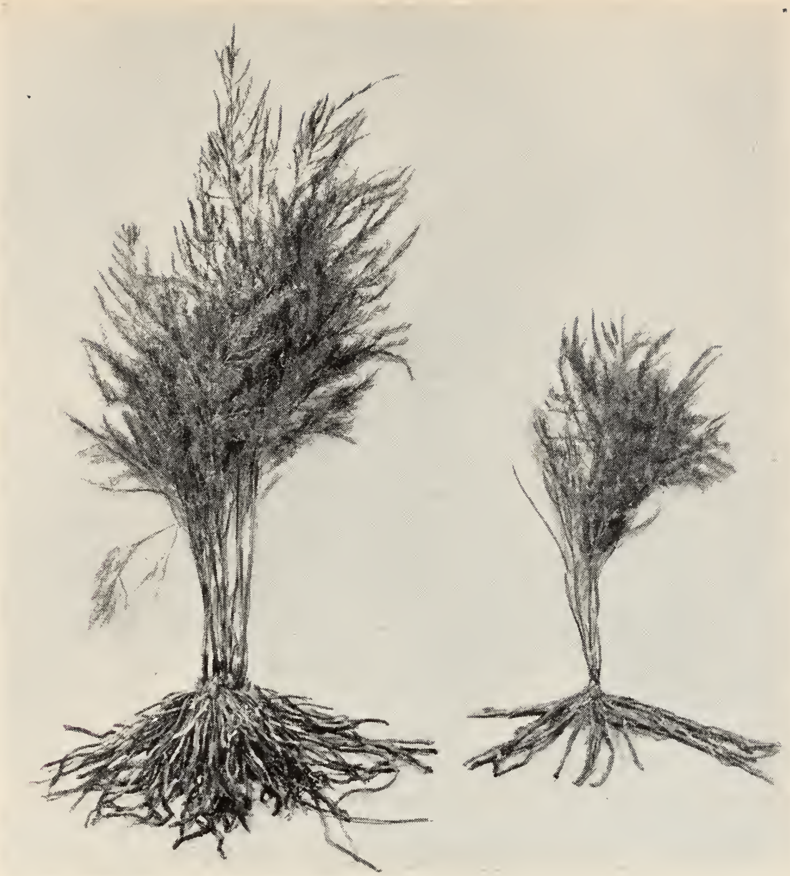

**Fig. 3.—The difference in size of these two plants, which grew side by side in a nursery, results from differences in heredity. The plants were spaced 6 inches apart in the row.**

January and February are perhaps the best months to plant. Usually conditions of soil and climate will permit the crowns to be transplanted from nursery to field to start growing the latter part of February. If the crowns are planted long before growing conditions are favorable, considerable decay often occurs on injured parts of the fleshy roots and rhizomes which make up the crown. If such decay advances too far, many crowns will die in the field and a poor stand will result.

Dipping or dusting the crowns to prevent decay has not been found practical, nor has any other suitable preventive been found.

**Spacing the Rows.** The distance between the rows will depend upon whether the spears are to be harvested white or green. If white is to be cut, the distance between the rows must be sufficient to accommodate a ridge of soil over the row without plowing too deep. The standard distance for such beds is 7½ to 8 feet, and should not be less than 7 feet. Fields on which only green asparagus is to be harvested can be planted closer, although there are no data available to show how close plantings can be made without actual crowding.

**Spacing in the Row.** Experiments on Ryer Island in the Delta show that higher yields are obtained when plants are spaced 12 inches apart in the row than when they are spaced wider (fig. 5). Tests made at the College of Agriculture, Davis, showed very little yield difference between 12- and 18-inch spacings. Figure 5 shows that as the age of the asparagus bed increases, the yields from all the wider spacings tend to approach the yields from the 12-inch spacings. Closer spacings give materially higher yields only during the early life of the bed. In the Ryer Island experiments there was no noticeable difference in size of spears at any spacing.

**Plowing the Furrows.** Furrows are made with a large double moldboard plow with extension wings. Wheel plows give better results than walking plows; they involve less side movement and make straighter rows. Often some sort of a weight (whatever is readily available, such as a clod smasher) is dragged behind the plow (fig. 6) along the bottom of the furrow to break clods that roll in. This also helps firm the soil and gives a smoother surface for placing the crowns.

**Planting.** The crowns should be planted as soon as possible after they are removed from the nursery. If weather conditions do not permit planting at the time of digging, crowns should be stored in a well-ventilated warehouse. Crowns are hauled to the field and placed in large piles, spaced to reduce the necessary walking by planters. The planting is done by hand. About 2 acres is an average day's planting for a man, in fields where the rows are 8 feet apart. From 100 to 150 crowns are carried at a time in a burlap bag slung over the shoulders. Each crown is dropped in the furrow with the buds pointing up. Spacing is usually estimated by the workers, the distances being checked once in a while to insure uniformity.

Depth of planting depends on the soil type. In sandy loams or peat soils, planting should be deeper than on heavier soils. In the Delta, on light peat soils, much of the top soil is lost by wind erosion during the cutting season. If plantings are too shallow in these soils, the crowns are soon exposed. The usual depth in the Delta is from 8 to 12 inches, 10 inches being the most common. On Ryer Island, experiments showed no great dif-

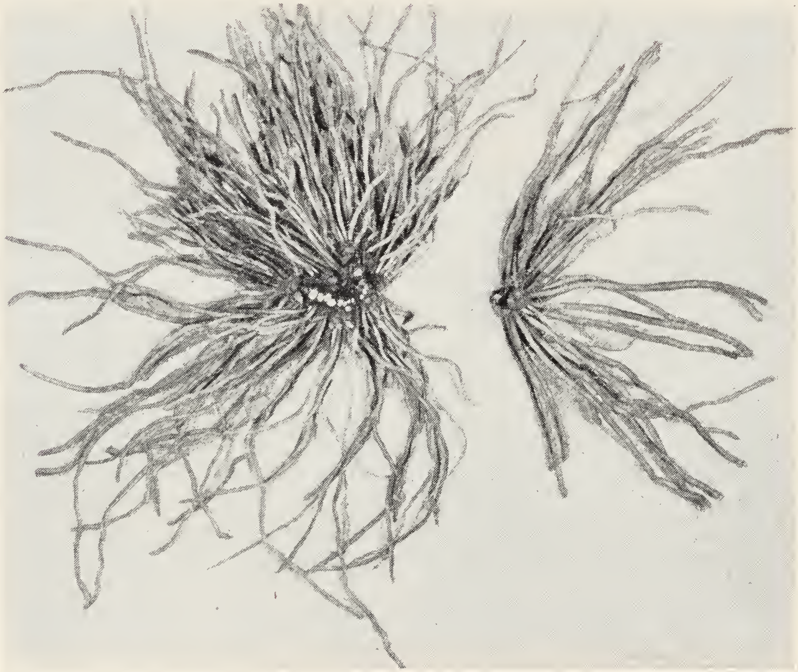

Fig. 4.—Plants in figure 3 with the tops removed.

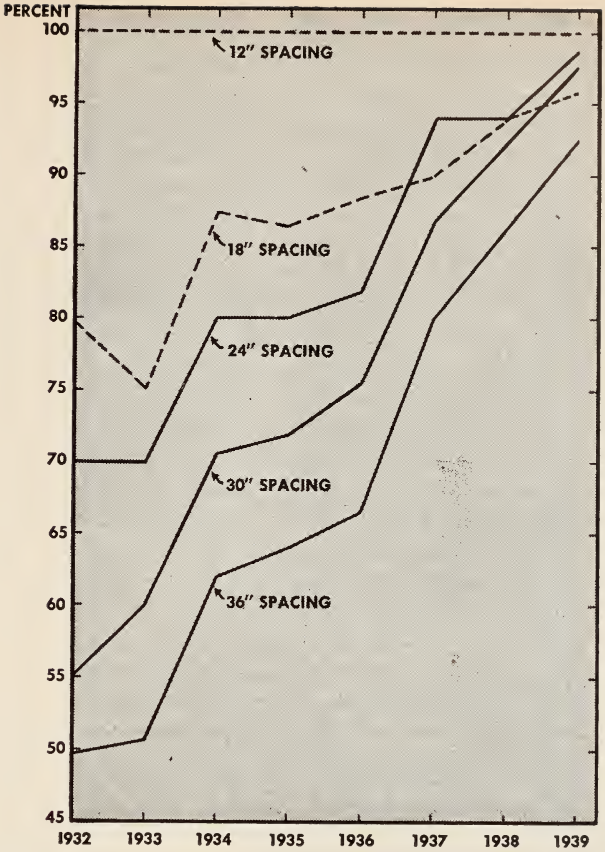

Fig. 5.—Ryer Island experiments showing percentage of yield at various spacings. 12-inch spacing is taken as a basis.

ference in yield on plantings that were variously set 5, 8, and 12 inches deep. At Davis, crowns set 8 inches deep gave higher yields than those planted 12 inches deep.

Immediately after planting, the crowns should be covered to a depth of 2 or 3 inches. This is done by means of a cultivator that pulls the soil from the sides of the furrow.

**Life of the Plantation.** The average profitable life of an asparagus plantation in the Delta is from ten to fifteen years. This period includes the first three years of the plantation. On light or peat soils the beds decline very rapidly after the eighth year; on the heavier type soils this decline does not begin until about the twelfth year, provided the beds have not been overcut or otherwise abused. The profitable life of the plantations in San Fernando and Imperial valleys is generally shorter.

**Replanting.** Just how soon old asparagus land can be replanted to this same crop is a much-debated question. Probably replanting should not be done before seven to ten years after the removal of the crowns (fig. 7) from the field. There is no information available as to the best crop to grow on the soil during this period, although alfalfa and other crops may be grown. On Ryer Island, replanting between old rows immediately after the old bed had been plowed out never gave more than 50 per cent of normal yield. Deep plowing or subsoiling will help destroy old asparagus roots, which remain alive for several years after the crowns are destroyed.

## Caring for the Established Plantation

**First Year.** Cultivation for the first year consists of filling the furrows and keeping down weeds. Many weeds in the rows may be killed when still small by being covered with soil as the furrows are filled. If the land is foul with weeds, several hoeings may be necessary.

The field should be well irrigated the first year. In seasons of light rainfall, or where planting has been done after the rainy season, an irrigation soon after planting may be desirable. If water is run down the rows the soil is firmed around the crowns, and growth is hastened. The fleshy roots of the crowns elongate in moist soil only. As the stored food supply is very limited in crowns when they are planted, they ought to become well established as soon as possible. Good care of the bed the first year is particularly important.

At the end of the first season's growth, after the frost has killed them, the tops are cut, raked, and burned. Because peat land will burn readily, the tops should not be burned on such soils unless there is sufficient moisture to prevent ground fires.

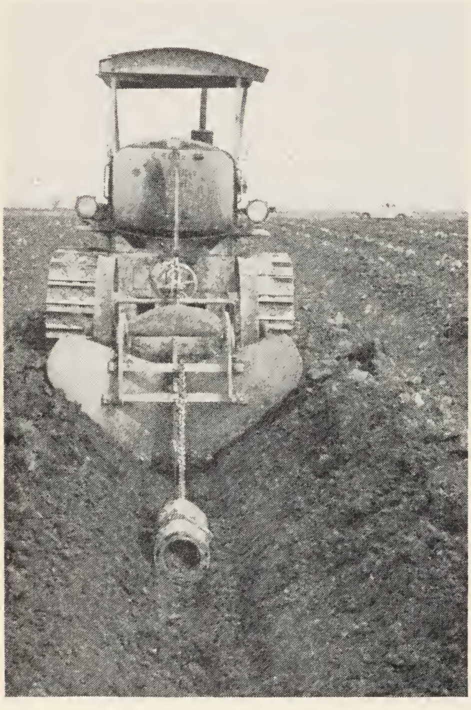

Fig. 6.—Opening plow making trenches preparatory to planting, and dragging a clod smasher in the furrow.

**Second Year.** Usually during the winter the land is thoroughly disked and left level. Since the stubble disintegrates readily, it does not interfere with harvesting. In California, the usual practice is to cut the two-year-old field for 3 or 4 weeks, or until the spring frost hazard is over, unless there was poor fern growth the first year. Only green asparagus is harvested. After the cutting is over, the tops are allowed to grow. Most growers cultivate the bed deeply between rows, and some of them subsoil to a depth of 12 to 18 inches in order to loosen the soil and allow water movement. According to Ryer Island findings, however, deep cultivation or subsoiling reduces the asparagus yield of the following year. All the reserve food of the next year's crop is stored in the fleshy roots of the plants during the summer and fall, and any cultivation that tends to destroy the roots will decrease the next yield.

**After the Second Year.** The third year, the field may be cut for 8 to 10 weeks; in following years, throughout the regular cutting season. Harvesting of asparagus usually starts in February or March and ends in June. In the fall, after frost has killed the plant tops, they are cut with a mower, raked, and burned. On peat soils it is better not to burn the tops until after the first rains. As has already been mentioned, dry peat soils will burn and the crowns, therefore, will be killed. After the tops have been disposed of, the field is disked, and a low ridge of soil is made over the rows to hasten decomposition of the stubble. After the fourth or fifth year, care is necessary to keep from cutting the crowns as they approach the surface. Any destruction of the buds will decrease the next year's yield.

For green asparagus, which is harvested until about April 1, when the canneries start packing asparagus, only a low ridge is necessary. Older beds require higher and wider ridges—high enough to keep the crowns from being touched with the knife when the spears are cut off just below the ground.

For white asparagus, the ridges are made high enough so that the spears can grow 8 or 9 inches below ground without being cut too close to the crown. The ridges are rebuilt every 18 to 21 days throughout the cutting season, as they gradually become torn down by wind or cutting. After the cutting season, the ridges are partially disked down and then flattened by means of a large weighted wooden beam used as a drag. Throughout the summer, cultivation is done only to keep down the weeds.

When cutting is changed from green to white, the ridge is disked down to kill weeds and loosen the soil. The soil should be well pulverized before being put back on the ridge, and a float should be dragged behind the ridger (fig. 8) to help pack and pulverize still further. A cloddy ridge allows light to filter into the soil, and the spears become green before they show above the top of the soil. Also, the spears are more likely to be crooked when they are forced to grow around clods.

In the Delta, most asparagus fields are subirrigated. Usually one or two irrigations are applied during the cutting season and one or two during the summer months. On heavy soils that do not subirrigate easily, surface irrigation is applied in furrows between the rows, usually one furrow every other row. Some growers who are working lighter soils, use surface irrigation to leach alkali out of the upper soil area. In the San Fernando and Imperial valleys only surface irrigation is practiced. Water should penetrate to a depth of at least 8 to 10 feet. Irrigations should be frequent enough to maintain available moisture throughout the root zone during the growing season.

The practice of winter flooding (De-

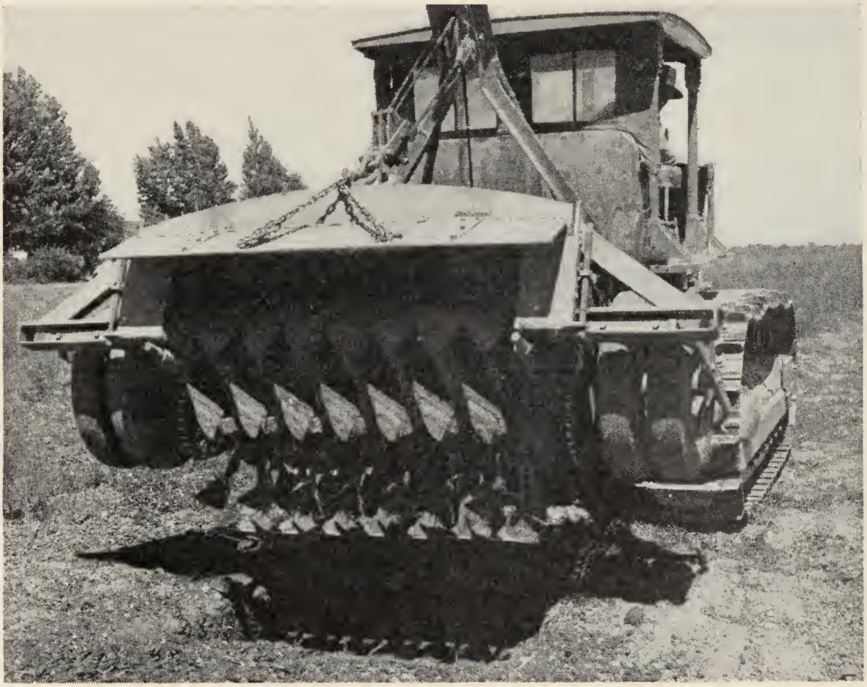

Fig. 7.—Rotary plow destroying crowns at the end of profitable life of asparagus bed.

cember or January) has become general on the older beds in the Delta. Levees are made around the field, so it can be flooded to an average depth of 6 to 12 inches for a period of 4 to 6 weeks. Usually a few rows of asparagus are left with the tops uncut, next to the levee, to check wave action, and the levee is further protected by a thick lining of matted fern. In January or early in February, depending upon weather conditions, the water is drained off. As soon as the field is dry enough, the between-row centers are worked, and a small ridge made over each row.

Fields flooded during the winter start to produce from 10 to 14 days earlier than unflooded fields. In Arizona, Working[2] found that growth started at 59° F when an abundance of moisture was present, but that plants remained dormant at 63° when the soil was barely moist. Many growers believe that flooding shortens the life of the bed. Experiments have shown that there is apparently no harmful effect in flooding; therefore any ill effect must come from cutting too long after flooding. Flooding in connection with good drainage may be very beneficial on subirrigated soils with a high salt content; it tends to leach the alkali out of the upper soil surface.

Table 1 shows the performance of a seven-year-old flooded bed of Mary Washington asparagus on the Egbert Tract on the western side of the Sacramento-San Joaquin Delta, cut for different lengths of time. The field was flooded for 4 weeks in December, 1930. In 1931, the quality of the asparagus fell off rapidly in plots cut after June 1. In 1932, the quality was

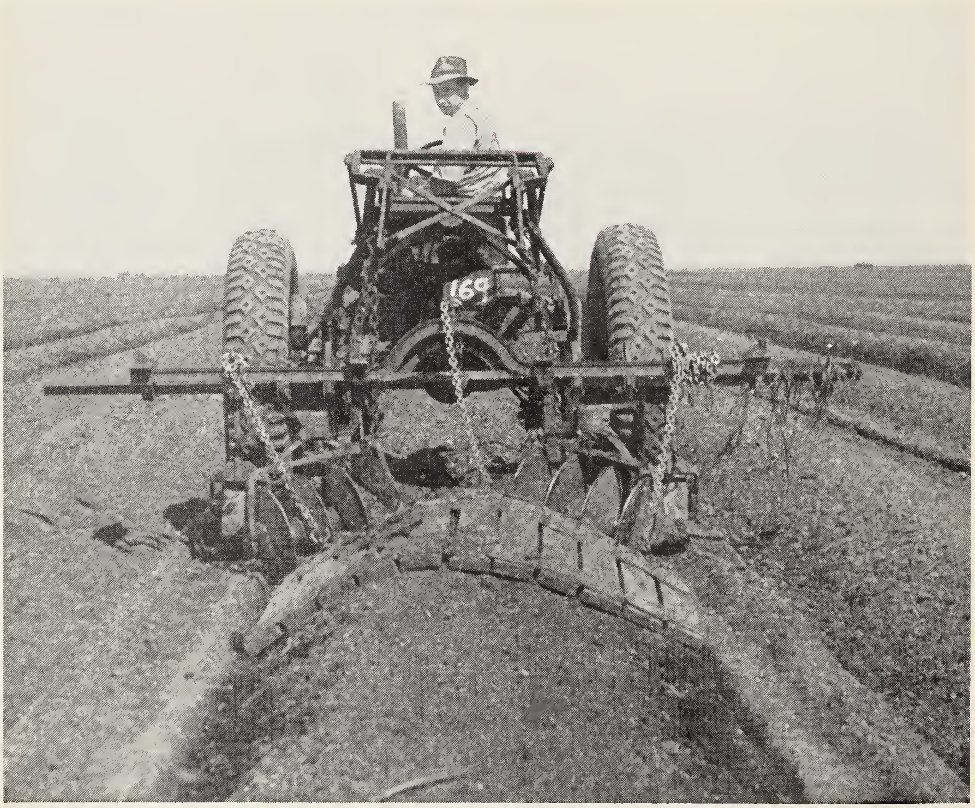

Fig. 8.—Ridger and float for preparing re-ridges for white asparagus.

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[2] Working, E. B. Physical and chemical factors in the growth of asparagus. Arizona Agr. Exp. Sta. Tech. Bul. 5:87–124. 1924.

**Table 1—Performance of Flooded Asparagus Beds during the Dormant Season; Mary Washington Variety, Delta Region***

| Plot | 1931 season | | 1932 season | |
|---|---|---|---|---|
| | Cut until | Yield per acre | Cut until | Yield per acre |
| | | pounds | | pounds |
| A | April 20 | 2,182 | June 15 | 6,384 |
| B | May 1 | 3,236 | June 15 | 6,825 |
| C | June 1 | 4,937 | June 15 | 5,937 |
| D | June 15 | 5,635 | June 15 | 5,867 |
| E | July 1 | 6,389 | June 15 | 5,119 |

* From: Hanna, G. C. The effect of the duration of cutting season on asparagus that has been flooded. Amer. Soc. Hort. Sci. Proc. 29:466–67. Table 1. 1932.

also poorer on those plots cut after June 1, 1931. The data are not considered sufficient to determine the length of cutting after flooding, but probably the beds should not be cut later than June 1 under these conditions.

## Fertilization

Fertilizers are not recommended for virgin and replanted asparagus peat-sediment lands. In trials conducted on Ryer Island, such lands failed to respond to any fertilizer treatment regardless of kind, rate, or time of application. Because of the nature of these soils, it is probable that normal nitrification is enough to meet the nitrate requirements.

On mineral soils an annual application of 100 pounds of nitrogen per acre would probably give good results. This is particularly true of the lighter soils. The fertilizer should be applied between the rows at the end of the cutting season, and cultivated into the soil.

## Harvesting Asparagus for the Market

**Cutting and Hauling.** In the early part of the cutting season in the Sacramento-San Joaquin area, cutters go over the field and harvest by hand (fig. 9) any spears of sufficient length, every 2 or 3 days according to the rate of growth. Later the beds are cut every day. In the San Fernando and Imperial valleys, the fields may be gone over twice daily during the warm weather.

If asparagus is to be shipped to the fresh market, spears are cut 10 to 12 inches long, showing as much green as can be secured along with a tight head. Usually the cutter does not harvest according to the length of the green alone, but also considers the compactness of the head. The higher the temperature, the closer to the ground the spears will begin to branch. Spears having heads that tend to open early, and, consequently, having a shorter length of green, are cut somewhat sooner than those that tend to open late.

Early in the season, when the yield is small, cutters may carry baskets or specially constructed carrying boxes, from which the spears are transferred to 50-pound lug boxes at the end of the row. Later in the season, when production is heavier, the spears from six rows are placed in small piles on the two center rows, commonly called a sled row. The spears are hauled in horse-drawn or motorized carts (fig. 10) directly to the packing shed. If the shed is at a shipping point instead of on the ranch, the spears are placed in lug boxes as they are picked up from the field, and are carried to the ends of the rows. Trucks then haul the lugs to the shipping shed.

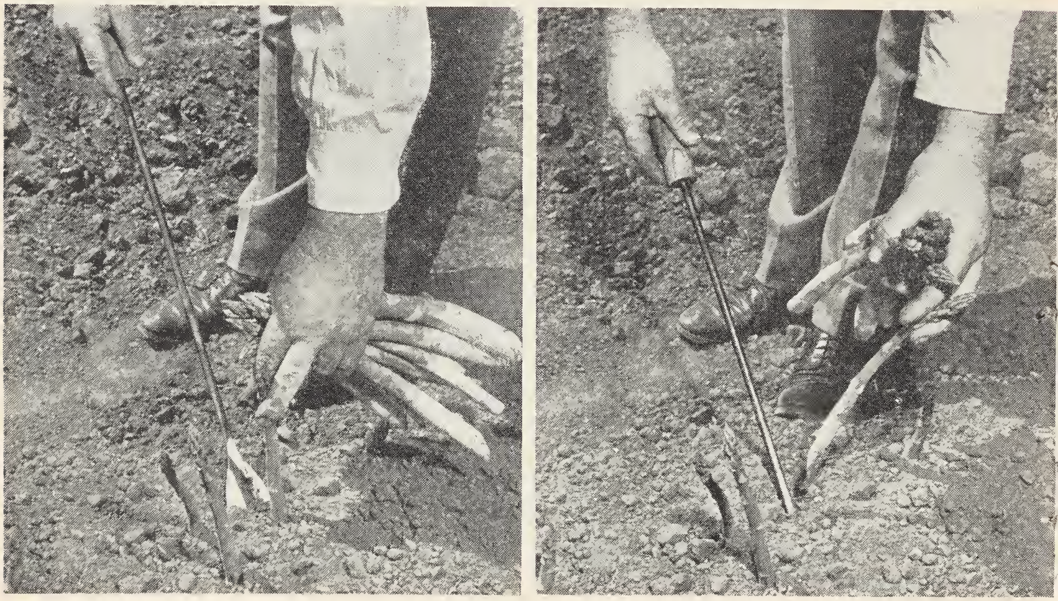
**Sorting, Grading, and Packing.** In California there are two types of pack: the loose pack and the bunch pack. Most markets in this state prefer the loose pack.

Smaller grades are usually put in loose pack, the spears trimmed to 9 inches in length. After trimming, the spears are placed in a pyramid crate, on the bottom and two sides of which oiled or waxed paper has been placed. On the paper at the bottom is commonly laid a layer of wet moss or some other suitable absorbent material. During packing the crate rests on its side. To make handling easier, a tin sheet having the dimensions of the bottom of the crate is placed on top of the wet moss. The butts (cut ends) of the spears are placed against the tin sheet; and when the crate is filled the sheet is pulled out, leaving the butts of the spears on the water-soaked material. The oiled paper is then folded over the open side, and the side and top slats of the crate are nailed on. Crates are packed with a good bulge, so that if wilting occurs the pack will remain tight.

The bunched pack, for which all grading is done by hand, takes care of four to six grades, made on the basis of the diameter of the spear (fig. 11). The different grades are tied in bunches weighing about 2½ pounds each. The spears are placed in a buncher, squeezed together by means of a lever, and tied securely with ¼-inch tape. Different-colored tapes are used to mark different grades. If the spears are slightly wilted, a tighter pack can be obtained, for they later absorb water from the moss in the crates and regain their turgidity.

After being securely tied, the bunches are removed from the buncher and the asparagus trimmed to 9 inches in length with a large knife or circular power knife. The bunches are then placed upright with the butts in a pan holding cold water 3 or 4 inches deep, to remain so until packed.

For packing, they are wrapped in parchment label, and placed in the crate with the butts resting on the wet moss. Top and side boards are nailed on. Nearly



all bunches are shipped in two-compartment, standard-sized, pyramid crates.

**Inspection.** The graded asparagus is inspected for conformity with the Agricultural Code of California pertaining to shipments of fresh asparagus. (Please turn to page 18 for excerpts from the Agricultural Code.)

## Harvesting Asparagus for the Cannery

**Cutting and Delivering.** Canneries usually begin packing asparagus about April 1 in California. By this time, the daily yield is usually sufficient to bring down the fresh market price to that paid by canneries.

When white asparagus is to be delivered, the spears are cut just as they emerge through the soil surface. For green asparagus, the spears must have at least 3½ inches of green. All cannery asparagus is trimmed to 7 inches before being delivered. Grading is done at the canneries.

White asparagus is brought from the field to the wash sheds. On small plantings the wash shed is located in the field, usually one shed to every 100 to 150 acres. The asparagus is taken from the sled boxes and put on a rack where it is trimmed to length; then washed, placed in 50-pound lug boxes, lidded, and hauled to the cannery. On larger plantings a central wash shed is used, usually (in the Delta) located on a slough. The sled boxes are left on loading platforms conveniently located in the field. Thence the boxes are trucked to the central wash shed, where the asparagus, trimmed by machine, is washed by spraying water under high pressure on the spears. It is then crated and sent to the cannery by truck.

## Insect Pests and Diseases of Asparagus

As compared with most cultivated crops, asparagus in California is relatively free from insect pests and diseases. The asparagus beetle and garden centipede are apt to be troublesome pests, while asparagus rust and rusty discoloration are bothersome diseases.

**The Asparagus Beetle.** The common asparagus beetle, *Crioceris asparagi* L., is found in nearly all the asparagus-growing sections of the United States and is very common in Europe. It is about ¼ inch long, of a steel-blue color with a red thorax and with yellowish spots on the wings. The mature larvae are about ⅓ inch long, soft, fleshy, much wrinkled, and smoky gray. They drop to earth from the plants and form small, earth-covered cocoons.

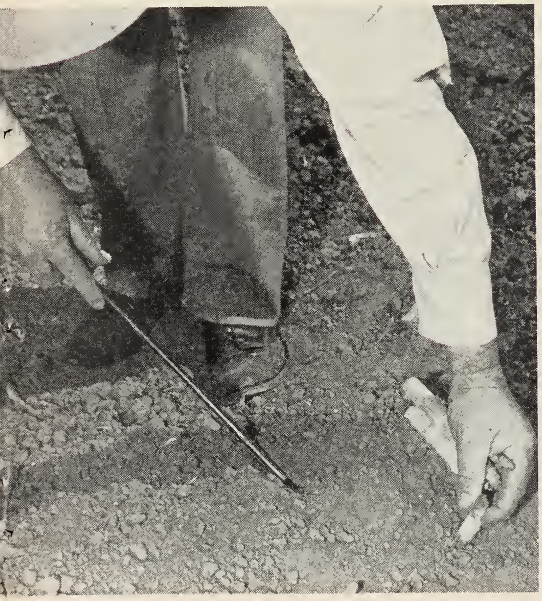


Fig. 9.—Cutting asparagus: left to right, close-up showing insertion of cutting knife to harvest green asparagus; cutting the green stalk; harvesting a white stalk (note that knife is inserted farther from the stalk).

The mature beetles attack both the spears and the stalks. Early in the spring the adults feed upon the growing spears, causing distorted growth and lowering the market value of the product. After the cutting season, both the adults and the larvae feed upon the top growth of the plants. Severe infestations often kill the tops, especially the upper portion. In California most of the damage is confined to young asparagus fields. Overwintering adult beetles have a chance thus to deposit eggs on the young fern growth. The larvae appear in 3 to 8 days; the life cycle is completed in 3 to 4 weeks. There are many overlapping generations. On young fields the population increases rapidly, and serious injury may result if control measures are not taken.

The asparagus beetle has many natural enemies. Several species of ladybird beetles feed upon the eggs, while the numerous soldier bugs and dragonflies prey upon the larvae. In the Delta, large flocks of blackbirds feed upon both larvae and adults.

A very satisfactory control can be obtained by dusting the fern tops with one part of powdered lead arsenate to 10 parts of air-slaked lime, applied in the morning while the dew is still on the plants. Various methods of dusting are employed. Another satisfactory control is a spray consisting of 4 pounds of lead arsenate paste and 4 pounds of resin fish oil soap to 50 gallons of water. Ordinary spray outfits are used.

**The Garden Centipede.** The garden centipede, *Scutigerella immaculata* (Newp.), is by far the most serious pest to the asparagus industry in California. Though small, these pests are very destructive when they occur in large numbers. When mature they are about ¼ inch long with delicate soft bodies. In feeding they make a large number of small, round holes in the underground portion of the spear. Around these holes numerous hard

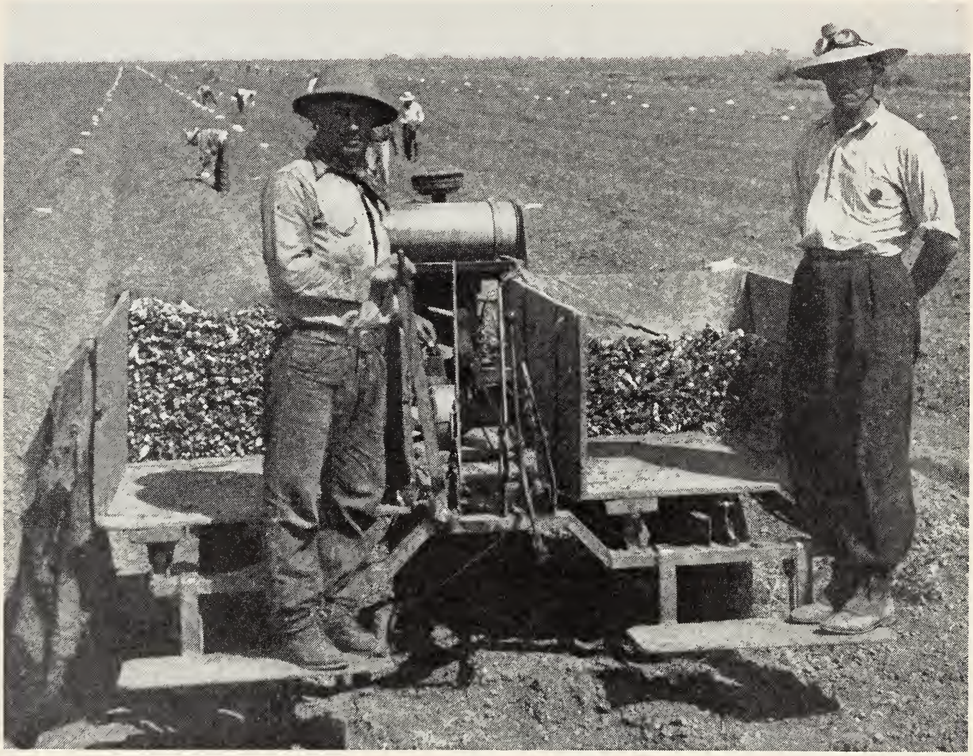


Fig. 10.—Pickup cart, motorized, which follows cutters in the field.

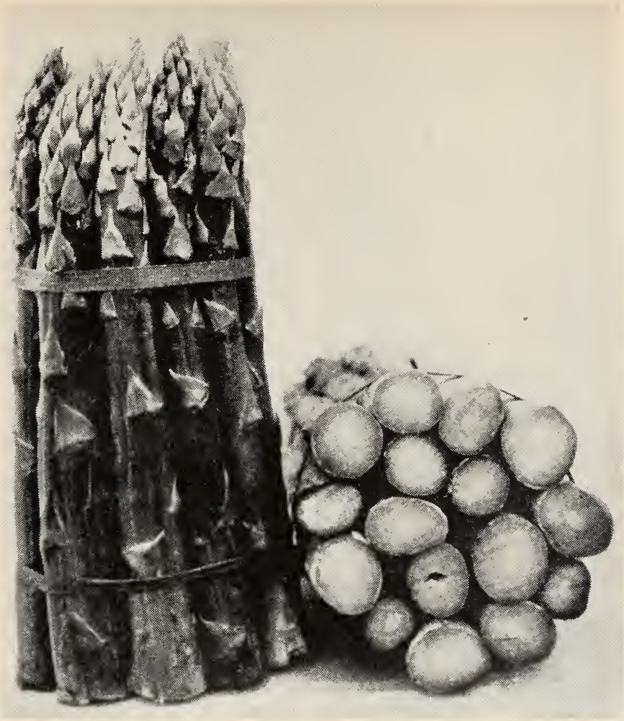


**Fig. 11.—Jumbo grade of asparagus, bunched ready for packing. (*Courtesy U.S.D.A.*)**

fibers are formed, making the spear unfit for canning. When the centipedes are abundant in the soil, practically all the spears in the infested area will be injured. The top growth of such fields is reduced, and often the plants are killed. Usually only green asparagus is cut from badly infested fields; the green portion growing above the ground is not injured.

When infestations are scattered throughout the field, flooding is the only practical means of control. A sufficiently high levee is made around the field to hold water a foot or more in depth on the entire field for 3 or 4 weeks during December and January. All high places should be completely covered, with no stubble showing above the surface of the water.

For very small infestations, control may be obtained by using 2 ounces of carbon disulfide in holes 12 inches deep and 18 inches apart each way. Paradichlorobenzene has been found effective when applied at the rate of 600 to 900 pounds per acre during warm weather. These chemicals are injurious to plants and would probably kill the crowns wherever they are applied, but on small infestations such a drastic control method might be justified. However, it would be safer to consult an entomologist before applying such measures.

**Asparagus Rust.** The disease asparagus rust, caused by *Puccinia asparagi* D. C., first discovered in America in 1896, had spread to California by 1901. It is readily recognized by brown, rusty spots on the stems and branches of the fern. In severe infestations the whole field takes on a brown, rusty color. As this disease is prevalent only where summer rains or dews are encountered, it does little damage in the interior valleys, although in some years the rust has been rather severe. Smith,[3] working in California, obtained good control from 25 to 30 pounds per acre of finely ground sulfur, applied as a dust about 3 weeks after the cutting season and followed by another application a month later. Fair control has been obtained by cutting, raking, and burning the tops in midsummer, the second top growth being relatively free of the disease.

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[3] Smith, R. E. Asparagus and asparagus rust in California. California Agr. Exp. Sta. Bul. 165:1–99. 1905. (Out of print.)

The introduction of the rust-resistant Mary Washington asparagus has reduced the rust hazard somewhat in California. This variety is now generally planted in all sections of the state.

**Rusty Discoloration.** Another disease generally known as rust causes a rusty discoloration on white asparagus. It is due to soil organisms, principally *Rhizoctonia* species. In advanced cases there are sunken areas on the spears, but usually the spear is cut before the disease advances very far, so that only the rust-colored spots are present. This disease is most prevalent in fields that have a high water table or have recently received a heavy irrigation. To prevent the condition, the soil should be kept from becoming too moist above the crowns. Good drainage is essential at all times.

## Excerpts from the Agricultural Code of California

(Revised to Sept. 13, 1941)

810.5 Fresh asparagus shall not be wilted, or crushed (except such injuries as are necessarily caused in proper sorting or packing); stalks shall not have badly broken, badly spreading or badly seeded tips and shall be free from decay and from damage caused by dirt, disease, insects, mechanical injury or other causes. Stalks of asparagus, when bunch packed, shall not be badly crooked. "Damage" means any injury from the causes mentioned which materially affects the quality.

Not more than 10 per cent, by count, of the asparagus stalks in any one container or bulk lot may be below these requirements, but not to exceed one-half of this tolerance shall be allowed for any one cause. Asparagus which fails to meet these requirements only because of being "badly crooked" shall be considered as complying with this standard if the container in which it is packed is plainly marked on the outside of the end bearing other markings required by this section, in letters not less than one-half inch in height, with the word "crooks."

Bunches of asparagus classified according to the following designated size grades shall contain the number of stalks indicated in each classification and shall weigh not less than two pounds net when packed, except that bunches smaller than two pounds net when packed, with a proportionately less number of stalks per bunch, may be so classified if the container is conspicuously marked, on the outside of the end which bears any marks intended to describe the contents of such container, in letters not less than one-half inch in height, with the number of bunches and the minimum weight per bunch. Not less than 12 bunches of asparagus so classified may be packed in standard container number 51 or 52.

**Colossal, not more than 14 stalks to a bunch.**
**Jumbo, 15 to 20 stalks to a bunch.**
**Extra select, 21 to 28 stalks to a bunch.**
**Select, 29 to 42 stalks to a bunch.**
**Extra fancy, 43 to 67 stalks to a bunch.**
**Fancy, 68 to 100 stalks to a bunch.**

In view of differences in climatic and other natural conditions prevailing south and east of San Gorgonio Pass, which cause fresh asparagus grown in that area to be satisfactory in quality only if a large portion of the stalk is green or colored, and therefore must be cut at a shorter length, as compared to asparagus grown in the area north and west of the San Gorgonio Pass, stalks of asparagus produced in the area south and east of San Gorgonio Pass, shall have not more than two inches of white on the butt, except that not more than 20 per cent of the stalks in any bunch, or when not packed in bunches, 20 per cent of the stalks in any container, may have not to exceed two and one-half inches of white. When the stalks of asparagus produced in this area are less than seven and one-fourth inches in length and packed in bunches they shall be classified according to the following designated size grades:

**Mammoth, not more than 17 stalks to a bunch.**
**Giant, 18 to 24 stalks to a bunch.**
**Fancy regal, 25 to 34 stalks to a bunch.**
**Regal, 35 to 52 stalks to a bunch.**
**Fancy standard, 53 to 78 stalks to a bunch.**
**Standard, 79 to 115 stalks to a bunch.**
**"Crooks" when packed in bunches shall have no more than 67 stalks to a bunch.**

The number of stalks of asparagus packed in bunches shall not vary more than 10 per cent from the count of the grade classification as marked, except that 10 per cent, by count, of the bunches in any one container may exceed this tolerance.

All containers of asparagus packed in bunches shall bear upon them in plain sight and in plain letters on one outside end, the name of the person who first packed or authorized the packing of the asparagus, or the name under which such packer is engaged in business, together with a sufficiently explicit address to permit ready location of such packer, the net weight, and in letters not less than one-half inch in height, the grade classification as herein established, except that crates of bunch packed asparagus which is badly crooked and so marked with the designation "crooks" need not bear any other grade classification; and in the case of bunches smaller than two pounds, with the number of bunches and minimum weight per bunch. When bunches of different grades are packed in one container, the markings on each container shall clearly show the number of bunches of each grade.

If 90 per cent, by count, of the stalks of asparagus in any one container have less than 50 per cent of the length of the stalk white, the containers may be marked with the term "green."

Asparagus packed in bunches in which the stalks are seven and one-fourth inches or longer in length shall be in standard container number 51. Asparagus packed in bunches in which the stalks are less than seven and one-fourth inches in length shall be in standard container number 52. Other size containers may be used if conspicuously marked on the outside of the end which bears any marks intended to describe the contents of such container, in letters not less than one-half of an inch in height with the words "irregular container." (Added by Ch. 332, Stats. 1933; amended by Ch. 60, Stats. 1935.)

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J. Earl Coke, Director, California Agricultural Extension Service.

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